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Gender- Specificity in Viewing Time among Heterosexual Women

ABSTRACT

Measures of sexual interest tend to be more gender-specific in heterosexual men than in heterosexual women. Cognitive measures, such as viewing time to attractive stimuli, may also show similar patterns of gender-specificity or non-specificity among men and women, and thus serve as useful adjuncts to more direct measures of sexual interest. The objectives of the present research were to determine the extent of gender-specificity in women's viewing times for female pictures (varying in their perceived physical attractiveness) and explore the influence of social comparison of physical appearance on these patterns of responses. In Study 1, we recorded only women's viewing times for pictures of both genders, measured self-reported menstrual cycle phase, and manipulated the waist-to-hip ratio of the women in the female pictures. In Study 2, we recorded women's and men's viewing times, self-reported sexual attraction to pictures of males and females, and physical appearance social comparison. Study 1 found that heterosexual women's viewing time towards female pictures was not associated with manipulation of the perceived attractiveness of those pictures. Study 2 found that heterosexual men were more gender-specific than heterosexual women in their viewing time patterns. We also found that reported sexual attraction and physical appearance social comparison were associated with heterosexual women's viewing times for female pictures, while heterosexual men's viewing times were associated with sexual attraction only. Our results are discussed in relation to the utility of viewing time as an indicator of visual attention towards attractive or sexually appealing visual stimuli.

KEY WORDS: gender-specificity; viewing times; sexual interest; physical appearance social comparison; heterosexual women

INTRODUCTION

Gender-specificity is a term sometimes used to define the degree to which sexual interest or arousal is dependent upon the gendered features of sexual targets (Huberman, Maracle, & Chivers, 2015). It is operationalized as the correspondence between an individual's sexual interest or arousal and self-described sexual orientation (Chivers, 2005). Sexual interest can be described as the tendency to respond sexually (e.g., having sexual feelings towards) to a preferred category (e.g., person, object or activity; Chivers, 2005). Sexual arousal refers to an emotional or motivational state initiated via the processing of internal or external sexual cues and that is a multifaceted construct including physiological (e.g., genital responses), psychological (e.g., subjective feelings), and behavioral responses (e.g., action tendencies) (Janssen, 2011). Although some research has shown that both heterosexual men and women are gender-specific in subjective sexual arousal (Chivers, Blanchard, & Seto, 2007; Chivers & Timmers, 2012), a number of studies have indicated that heterosexual men tend to be more gender-specific in their genital sexual arousal and sexual interest than heterosexual women. That is, heterosexual men's genital sexual arousal and sexual interest tend to be greater to sexual stimuli depicting women, whereas relative to men, women's genital sexual arousal and sexual interest tend to be similar to sexual stimuli depicting either men or women (Cerny & Janssen, 2011; Chivers, 2005; Huberman et al., 2015; Lippa, 2013; Lippa, Patterson, & Marelich, 2010; Rieger, Chivers, & Bailey, 2005; Suschinsky, Lalumière, & Chivers, 2009). These conclusions are based in part on studies of genital arousal which indicate that heterosexual men tend to be more aroused by sexual images of women than by sexual images of men (e.g., Chivers & Bailey, 2005; Huberman & Chivers, 2015; Rosenthal, Sylva, Safron, & Bailey, 2011; Sakheim, Barlow, Beck, & Abrahamson, 1985). In contrast, heterosexual women tend to be equally aroused by sexual images of both genders (e.g., Bossio, Suschinsky, Puts, & Chivers, 2014; Chivers, Rieger,

Latty, & Bailey, 2004; Peterson, Janssen, & Laan, 2010; Steinman, Wincze, Barlow, & Mavissakalian, 1981). Further evidence comes from studies of the viewing times of sexual stimuli. Some studies indicate that heterosexual men view female pictures significantly longer than they do male pictures, whereas heterosexual women do not show a difference in viewing times between male and female pictures (e.g., Chivers, 2010; Ebsworth & Lalumière, 2012; Wright & Adams, 1999). Other research indicates that the difference in viewing times is weaker among heterosexual women than it is for heterosexual men (e.g., Israel & Strassberg, 2009; Lippa, 2012; Quinsey, Ketsetzis, Earls, & Karamanoukian, 1996). Studies which quantify attention patterns towards sexual stimuli have indicated that heterosexual men tend to be gender-specific in self-reported attention, whereas heterosexual women are gender-nonspecific (Huberman et al., 2015). Studies using eye-tracking techniques also show that heterosexual men are more gender-specific in sexual interest than heterosexual women in measures of fixation duration and count (Lykins, Meana, & Strauss, 2008). One recent study using eye tracking reported that heterosexual men oriented more rapidly to female than male targets, while heterosexual women oriented at similar speeds to male and female targets. Although both heterosexual men and women exhibited gender-specific patterns of total fixation duration and count measures, the effect size was larger among heterosexual men (Dawson & Chivers, 2016).

Thus, it appears that a gender difference in gender-specificity for sexual interest is found in genital arousal and more cognitive measures, such as viewing time and visual attention. There are a number of methodological explanations for this gender difference. Heterosexual men may engage in conscious inhibition of genital arousal responses with some studies indicating that men are able to suppress their genital arousal (Mahoney & Strassberg, 1991; Winters, Christoff, & Gorzalka, 2008). Thus, heterosexual men may be able to demonstrate gender-specificity in genital arousal if they sufficiently control their genital

arousal to male pictures. There may also be differences in the validity of genital arousal measurement techniques used to assess female compared to male genital arousal (Chivers, 2005). For example, the concordance between women's subjective and genital arousal were significantly larger in studies using thermography than in studies using vaginal photoplethysmography (Chivers, Seto, Lalumiere, Laan, & Grimbos, 2010). However, recent work suggests that heterosexual men are indeed more gender-specific in their genital arousal than heterosexual women are using both thermography and plethysmography (Huberman & Chivers, 2015). Another explanation is that female genital response is a reflex elicited by sexual stimuli and so may be triggered by both the preferred and non-preferred sexual stimuli (Chivers, 2005; Laan, 1994; van Lunsen & Laan, 2004).

In relation to viewing time measures, while many studies assume that longer response latencies towards preferred sexual stimuli reflect a measure of sexual interest (e.g., Gress, 2005; Kalmus & Beech, 2005), it is possible that stimulus-specific processes (e.g., activation of neural reward system mechanisms, association-formation processes, or fantasizing) and task-specific processes (e.g. making judgment about gender, age, and sexual attractiveness of stimuli when rating sexual attractiveness) could contribute to longer viewing times towards sexually appealing targets under restricted task conditions (Imhoff et al., 2010; Imhoff, Schmidt, Weiß, Young, & Banse, 2012). It is also possible that, for social and cultural reasons (such as gender role expectations and stigma against same-sex attractions) men may be less likely than women to report same-sex attractions (Israel & Strassberg, 2009). Consequently, men may rate the male pictures as less attractive and spent less time viewing them. It is also possible that social comparison perceptions influence viewing time (Ebsworth & Lalumiere, 2012; Lippa et al., 2010). Specifically, heterosexual women's gender-nonspecificity may be the result of women comparing their own physical appearance with the female target's appearance. Women may attend to and compare their physical appearance with other women

to guide their own decisions about the presentation of their appearance or to identify potential intrasexual competitors (Maner, Miller, Rouby, & Gailliot, 2009). This might be due to women perceiving (for social or biological reasons, e.g., Buss & Barnes, 1986) that their attractiveness is based more on their physical appearance than is men's and so resulting in women paying more attention to other women's appearance. One of the objectives of the present research was to test the extent of gender-specificity in heterosexual women's viewing time towards pictures which vary in their perceived physical attractiveness and to explore the influence of social comparison of physical appearance on the pattern of responses.

The Role of Waist-to-Hip Ratio and Menstrual Cycle Phase

Research suggests that among women there is less separation between sexual interest and sexual arousal (Graham, Sanders, Milhausen, & McBride, 2004). In addition, a partner's physical attractiveness may influence women's level of sexual arousal (Graham et al., 2004). Thus, it is possible that cues such as physical appearance or attractiveness influence women's responses on measures that could potentially be used as adjuncts to standard measures of sexual interest, such as viewing time, visual attention, or pupillary responses. Indeed, some studies show that heterosexual men and women's viewing time and sexual attractiveness ratings for preferred sex increased as targets attractiveness increased (Lippa et al., 2010; Lippa, 2012). Thus it would appear that the greater the attractiveness of stimuli is associated with greater visual attention responses (e.g., more time spent viewing pictures with high attractiveness ratings). One common method of assessing women's perceived physical attractiveness is to manipulate visual depictions of the waist-to-hip ratio (WHR). WHR is the ratio between body circumference at the waist and at the hips (Singh, 1993). Studies have shown that women's WHRs may be used a cue to assess perceived attractiveness. Eye-tracking studies indicate that men spend more time and make more fixations upon the breast and waist-hip regions of female pictures (e.g., Dixon, Grimshaw, Wayne, & Dixon,

2011; Hall, Hogue, & Guo, 2011). Men also report greater attraction towards pictures of women with low WHRs (Dixson, Li, & Dixson, 2010; Mo et al., 2014; Singh, 1993, 2002; Suschinsky, Elias, & Krupp, 2007). Given the relation between women's sexual interest and their partner's physical attractiveness, and attractiveness and women's WHRs, it seems that manipulating the WHRs of the women pictured could be used to test whether heterosexual women's viewing times for female pictures are associated with the perceived attractiveness of those pictures and whether their viewing time patterns are gender-specific or not; this was the first goal of the present research.

An important confounding factor which might be associated with women's viewing time towards stimuli which vary in their perceived attractiveness is menstrual cycle phase. During the late follicular period, women experience a peak in estrogen followed by a rise in progesterone; which is associated with a marked increase in sexual interest during this phase (Durante, Griskevicius, Hill, Perilloux, & Li, 2011). However, this research is inconsistent. Some studies have demonstrated that fertility status at first exposure to sexual stimuli has a significant effect on subsequent sexual responses to such stimuli (Suschinsky, Bossio, & Chivers, 2014; Wallen & Rupp, 2010). Thus cycle phase during the initial exposure to sexual stimuli may have a stronger effect on women's sexual responses than the actual cycle phase at the time of testing. Other studies have reported that heterosexual women's sexual desire varies during the menstrual cycle (Rupp & Wallen, 2007; Wallen, 2001). For instance, during the follicular phase, heterosexual women reported more interest in sex (Schreiner-Engel, Schiavi, Smith, & White, 1981; Slob, Bax, Hop, Rowland, & van der Werff ten Bosch, 1996; Stanislaw & Rice, 1988; Zillmann, Schweitzer, & Mundorf, 1995) and increased sexual desire in diary studies (Bancroft, Sanders, Davidson, & Warner, 1983; Dennerstein et al., 1994). During the ovulatory phase heterosexual women were more likely to initiate sexual intercourse (Adam, Gold, & Burt, 1978; Bullivant et al., 2004; Van Goozen, Wiegant, Endert,

Helmond, & Van de Poll, 1997) ; reported more auto-sexual activity (Harvey, 1987); were more sexually aroused by erotic films (Slob, Ernste, & van der Werff ten Bosch, 1991); rated men other than their current partner as more sexually attractive (Larson, Pillsworth, & Haselton, 2012); and were more prone to fantasize about or have sexual intercourse with men other than their primary partners (Gangestad, Thornhill, & Garver, 2002). One study using eye tracking reported an increase in mean pupil diameter for sexually significant stimuli of participants' actual sexual partners during the ovulatory phase (Laeng & Falkenberg, 2007). It would appear that controlling for menstrual cycle phase is an important consideration when testing women's attention towards sexually appealing or attractive stimuli. Thus, here we also tested for possible differences in viewing time patterns among heterosexual women in relation to putative menstrual cycle phases (albeit measured via self-report).

The Role of Physical Appearance Social Comparison

As indicated earlier, social comparisons that are made during tasks involving stimuli of attractive conspecifics may influence the patterns of gender-specificity in women's viewing times. Social comparison is defined as the comparison of one's perceived social situation or attributes (e.g., one's abilities or appearance) with other conspecifics (Festinger, 1954). Social comparisons may be driven by a number of motivational states, including the perception of intrasexual competition. From an evolutionary perspective, guarding one's partner from potential intrasexual rivals can serve an important role in maintaining long-term romantic relationships (Sabini & Silver, 2005). Such mate guarding requires one to be able to identify potential intrasexual competitors, especially those who possess traits that indicate their desirability as a mate, such as greater attractiveness (Maner, Gailliot, & DeWall, 2007). Since men tend to prioritize female physical attractiveness, other attractive women may serve as potential intrasexual competitors for women (Brewer & Archer, 2007; Buss & Shackelford, 1997). Thus, it may be that women attend more to attractive same-sex targets as the result of

a motivation to “guard” their mates. There are a number of studies that indicate that women are sensitive to the physical attractiveness of potential competitors. For example, one study indicated that women use vocal femininity to track potential intrasexual competitors and are sensitive to acoustic parameters that have stronger influences on men’s preferences (Puts, Barndt, Welling, Dawood, & Burriss, 2011). Research also suggests that women tend to attend, encode and remember, and form strong implicit negative evaluations of physically attractive women (Maner et al., 2009). Maner et al. (2007) reported that women, especially those who felt insecure about their current romantic relationship, exhibited greater attention to facial pictures of attractive women. Maner, Gailliot, Rouby, and Miller (2007) also found that women who reported concerns about the threats posed by intrasexual competitors increased their attention to facial pictures of physically attractive women. Thus, it may be that women attend more to and compare their physical appearance to physically attractive women in order to identify potential intrasexual competitors. Thus, the second goal of the present research was to explore the influence of physical appearance social comparison on viewing patterns to attractive stimuli among heterosexual women.

The Present Research

Based on the literature reviewed above, here we report the findings from two studies that examined the extent of gender-specificity in heterosexual women’s viewing times for male and female pictures (which were manipulated on perceived physical attractiveness based on WHR) and to explore the influence of physical social comparison on these responses.

STUDY 1

Study 1 was designed to test whether heterosexual women’s viewing times for female pictures are associated with the perceived attractiveness of those pictures and whether their viewing time patterns are gender-specific or not. In Study 1, we recorded heterosexual women’ viewing times for pictures of both genders, measured self-reported menstrual cycle

phase, and manipulated the WHRs of the women in the female pictures. We predicted that heterosexual women's viewing times would be more gender-specific when viewing male pictures and female pictures with higher WHRs (less attractive) and more gender-nonspecific when viewing male pictures and female pictures with lower WHRs (more attractive). Specifically, heterosexual women were expected to view male pictures significantly longer than they did female pictures with higher WHRs, whereas heterosexual women were expected to not demonstrate any difference in viewing times between male and female pictures with lower WHRs. Moreover, we predicted that heterosexual women in the luteal phase would be more gender-nonspecific in viewing times, while women in the ovulatory phase would be more gender-specific in viewing times. Specifically, heterosexual women in the ovulatory phase were expected to view male pictures significantly longer than female pictures, while women in the luteal phase were expected to not demonstrate any difference in viewing times between male and female pictures.

Method

Participants

117 Chinese women were recruited from the Southwest University. Women's mean age = 21.26 years ($SD = 1.41$). Only the data of self-identified heterosexual women was analysed.

Questionnaire

The questionnaire asked participants for their written informed consent to take part in the study and demographic information about age, gender, and sexual orientation. Participants were asked to choose their sexual orientation from "gay/lesbian", "heterosexual", "bisexual" or "non-identified" labels (Ebsworth & Lalumiere, 2012). Female participants were asked to provide the exact start date of the last menstrual period, the typical length of their menstrual cycle and whether they were using any hormonal contraception. All women reported having regular cycles (e.g., cycle length between 25 and 32 days) and were not using

any hormonal contraception. Women were divided into two groups based on phase of menstrual cycle using the reverse cycle day (RCD) method (DeBruine, Jones, & Perrett, 2005; Gangestad & Thornhill, 1998; Haselton & Gangestad, 2006; Jones et al., 2005). Note we did not use biological methods to verify women's menstrual cycle status and the limitations of the RCD assessments of menstrual cycle phase are discussed below. Women on days 6–14 were classified as in the ovulatory phase¹ and women on days 17–27 were classified as in the luteal phase (DeBruine et al., 2005). Consequently, 59 and 58 women were assumed to be in the ovulatory and luteal phases, respectively.

Stimulus Materials

Pictures of young adult men and women wearing swimsuits or underwear were collected from the Internet (Lippa et al., 2010). They featured only one person per picture. Thirty pictures of men and 30 pictures of women were selected. These pictures were mainly of ethnic Chinese individuals, but some pictures of ethnic Caucasian persons were also included. To make sure that pictures collected are sexually attractive to the opposite gender, pictures were rated for sexual attractiveness by 34 judges who were not participants in the main study (these were all Chinese university students including 17 female judges for male pictures and 17 male judges for female pictures). They were asked to evaluate the pictures on

¹ Before we analyzed the effect of menstrual cycle on women's viewing time, we classified those women in the ovulatory phase into two groups: group 1 (women who were closer to the ovulatory period on days 12-14) and group 2 (women who were tested earlier in their cycle on days 6-11) to examine whether women who were closer to the ovulatory period showed a different pattern than women who were tested earlier in their ovulatory phase. A 2 (Ovulatory phase: Group 1, Group 2) \times 2 (Picture Type: Male, Female) repeated measures ANOVA did not reveal a significant main effect for ovulatory phase, $F(1, 57) = 0.04$, $p = .844$. Thus, women on days 6–14 were all included in the ovulatory phase.

perceived sexual attractiveness using a 7-point scale ranging from 1 (“*I am not at all sexually attracted to this person*”) to 7 (“*I am extremely sexually attracted to this person*”).

The mean sexual attractiveness of the male pictures as rated by female judges was 4.08 ($SD = 0.81$; Cronbach $\alpha = .91$) and the mean sexual attractiveness of the female pictures as rated by male judges was 4.59 ($SD = 1.01$; Cronbach $\alpha = .91$). Thirty female pictures were divided into three groups by matching on their mean sexual attractiveness ratings. There were no group differences in sexual attraction, $F(2, 27) = .002, p = .998$.

Photoshop 5.0 was used to manipulate WHRs of thirty female pictures (Streeter & McBurney, 2003). The WHRs of the original pictures range from .71 to .76. For pictures that were classified as having smaller WHRs, we narrowed the waist; for pictures that were classified as having higher WHRs, we widened the waist; for pictures that were classified as having normal WHRs, we made no changes (Henss, 2000; Suschinsky et al., 2007). Thus, we created three picture groups and each group had 10 pictures. The mean WHRs for the three groups separately were: .68, .74, and .89. Note these WHRs were measured from two-dimensional representations, so they were only approximate estimates of the three-dimensional WHRs. In addition, the female pictures that we used were mainly of Chinese women who appeared youthful and were assumed to be (based on their appearance) in their 20s and 30s. Jia, Xiang, Chen, Lu, and Wu (2002) found that a random sample of Chinese women aged between 20 and 29 years had an average WHR .75. In addition, the range of more than 90% of Chinese women’s WHR was between .70 and .90. Thus, the differences among these three groups are varied. The three groups of pictures were significantly different in WHR, $F(2, 27) = 326.24, p < .001$, partial $\eta^2 = .96$, with post-hoc testing (LSD) showing that all three contrasts differed significantly in WHR (all $ps < .001$).

Procedure

Participants completed the questionnaire one week before the experimental session,

and only heterosexual women in the ovulatory phase or luteal phase were selected. In the experimental session, participants rated all 60 pictures in a computer-run experiment in the lab using a 7-point scale ranging from 1 (*“I am not at all sexually attracted to this person”*) to 7 (*“I am extremely sexually attracted to this person”*). The pictures were presented in random order and there were no separate blocks for male and female pictures. Participants were instructed that they would have as much time as they wanted to inspect picture; to use the numeric computer keypad to indicate their ratings to each picture; and that the procedure was self-paced (i.e., to press “SPACE” for the next picture) but that they would not be able to go backwards or change previous ratings. E-prime 1.0 (Psychology Software Tools, Inc) was used to record sexual attractiveness rating and viewing time (in ms) for each picture.

Results and Analysis

Controlling for Outlier Values

Some trials were removed due to participant’s omission of sexual attractiveness ratings for certain pictures because they missed a picture (e.g., by moving too quickly through the task). Additional trials were removed based on outlier values for viewing times (e.g. those resulting from lapses in participants’ attention or fatigue during the task). We capped individual viewing time at 15 seconds in order to reduce the impact of outliers (Lippa et al., 2010). In total, 0.68% of all the trials were eliminated.

Data transformation

The raw viewing times and sexual attractiveness ratings for 60 pictures were standardized within-participants using z-scores. That is, for each picture, a z-score was computed by subtracting the overall mean and dividing by the standard deviation for that participant. For each participant, an average z-score was calculated for each picture type (e.g, pictures of female with WHRs of .74) (Ebsworth & Lalumiere, 2012). However, in order to make sure that tables and figures reporting viewing times and sexual attractiveness ratings are

meaningful to the readers, the raw viewing times and sexual attractiveness ratings are presented here.

Sexual Attractiveness Ratings

A 4 (Picture Type: .68, .74, .89, Male) repeated measures analysis of variance (ANOVA) revealed a significant main effect for picture type, $F(3, 348) = 34.37, p < .001$, partial $\eta^2 = .23$. Post hoc testing (LSD) showed that all six contrasts differed significantly (all $ps < .05$ and Cohen's d_z ranges from 0.33 to 0.75). Women's attractiveness ratings were highest to the male pictures ($M = 3.72, SD = 1.14$), followed by WHRs of .68 ($M = 3.27, SD = 1.58$) and .74 ($M = 3.06, SD = 1.47$), and WHRs of .89 is the least attractive ($M = 2.76, SD = 1.32$).

WHR and Viewing Time

A 4 (Picture Type: .68, .74, .89, Male) repeated measures analysis of variance (ANOVA) revealed a significant main effect for picture type, $F(3, 348) = 7.63, p < .001$, partial $\eta^2 = .06$. Post hoc testing (LSD) revealed that women viewed male pictures ($M = 3248.28, SD = 1108.21$) significantly longer than female pictures with WHRs of .68 ($M = 3074.33$ ms, $SD = 1128.70$), .74 ($M = 2834.29$ ms, $SD = 1032.53$), and .89 ($M = 3047.52$ ms, $SD = 1103.43$), $p < .05$, Cohen's $d_z = 0.19, p < .001$, Cohen's $d_z = 0.44$, and $p < .05$, Cohen's $d_z = 0.20$, respectively. Women viewed female pictures with WHRs of .74 for significantly shorter times than female pictures with WHRs of .89 and .68, $p < .01$, Cohen's $d_z = -0.27$ and $p < .05$, Cohen's $d_z = -0.34$, respectively. There was no difference in the viewing times for the female pictures with WHRs of .68 and .89, $p = .762$, Cohen's $d_z = 0.03$.

Menstrual Cycle on Women's Viewing Time

We computed women's weighted mean viewing times for female pictures with three WHRs and labeled it as the viewing time for female pictures. A 2 (Menstrual Cycle: Ovulatory, Luteal) \times 2 (Picture Type: Male, Female) repeated measures ANOVA revealed a borderline significant menstrual cycle by picture type interaction, $F(1, 115) = 3.94, p = .05$,

partial $\eta^2 = .03$. The interaction was examined further through simple effects analysis comparing viewing time for the two picture types separately by menstrual cycle. Figure 2 presents the viewing time as a function of menstrual cycle and picture type. The simple effects analysis revealed that women in the ovulatory phase viewed male pictures ($M = 3500.99$ ms, $SD = 1277.73$) significantly longer than female pictures ($M = 3068.91$ ms, $SD = 1017.31$), $p < .001$, Cohen's $d_z = 0.46$. For women in the luteal phase, there was no difference in viewing times for male ($M = 2991.20$ ms, $SD = 839.50$) and female pictures ($M = 2900.42$ ms, $SD = 971.58$), $p = .430$, Cohen's $d_z = 0.14$.

The simple effects analysis also revealed that women in the ovulatory phase viewed male pictures significantly longer than women in the luteal phase, $p < .05$, Cohen's $d = 0.47$. There was no difference in viewing times for female pictures between women in the ovulatory and luteal phases, $p = .114$, Cohen's $d = 0.17$.

Correlation between Sexual Attractiveness Ratings and Viewing Times

A within-participants correlation between sexual attractiveness ratings and viewing times for each participant was calculated based on 60 pairs of scores. An average correlation was then calculated (Ebsworth & Lalumiere, 2012). Women had an average correlation of .10 ($SD = 0.22$), indicating the correlation between sexual attractiveness rating and viewing times for women was small. In addition, in order to obtain approximate normality, the within-participants Pearson correlation coefficients were converted to z values using the Fisher's z transformation and an average z value was calculated, $z = 0.11$ ($SD = 0.24$), $p = .912$.

Discussion

In Study 1, we found that heterosexual women's viewing times were gender-specific regardless of the WHRs of the female pictures. We also found that whether heterosexual women's viewing times were gender-specific depended somewhat on menstrual cycle phase,

although this aspect of the result must be interpreted with much caution due to borderline significance (the borderline significant menstrual cycle by picture type interaction detected in the current research with a p -value of .05). Here, heterosexual women in the luteal phase tended to be gender-nonspecific in their viewing times, while women in the ovulatory phase tended to be gender-specific. We note that prior work indicates that menstrual cycle phase did not affect heterosexual women's gender-nonspecificity in genital arousal (Bossio et al., 2014). Thus, our findings appear to somewhat contradict the literature on genital arousal in heterosexual women but should be interpreted carefully and await replication. Other researchers have speculated that the female genital response is a reflex elicited by sexual stimuli (Chivers, 2005; Laan, 1994; van Lunsen & Laan, 2004). This may be a protective mechanism preparing the genitals for sexual activity via lubrication, facilitating penetration, and reducing the likelihood of genital injury or infection during sexual activity (Laan, 1994). In addition, studies suggest that women's genital responses are automatically initiated by exposure to sexual stimuli, whether or not these stimuli are preferred (Chivers, 2005; Chivers et al., 2010). Indeed, there are reports of women's genital responses and orgasms during sexual assault (Levin & van Berlo, 2004); furthermore, studies have shown that women experience genital responses to sexual threat stimuli (Both, Everaerd, & Laan, 2003; Both & Laan, 2007; Laan, Everaerd, & Evers, 1995; Suschinsky et al., 2009). Study 1 was focused only on exploring heterosexual women's gender-nonspecificity in viewing time patterns. Therefore, given that difference between viewing time and genital response as a measure of sexual interest or sexual arousal, women in the ovulatory phase may be gender-specific in their viewing time patterns.

We found that the WHRs of the female pictures were associated with women's sexual attractiveness rating and viewing time. Specifically, women's attractiveness ratings were negatively associated with WHR, which is consistent with previous research (Dixson, Dixson,

Li, & Anderson, 2007; Dixon et al., 2011; Furnham, Tan, & McManus, 1997; Platek & Singh, 2010). However, women viewed female pictures with WHRs of .89 significantly longer than female pictures with WHRs of .74. Moreover, women's patterns of reported sexual attraction by WHR were not entirely consistent with patterns of viewing time by WHR. Thus, the weak relationship between women's viewing time for female pictures and sexual attractiveness ratings here may indicate that heterosexual women's viewing times for female pictures is not strongly related to the perceived attractiveness of female pictures.

The findings of Study 1 very tentatively suggested that menstrual phase was associated with heterosexual women's viewing times for male pictures. Women in the ovulatory phase of their menstrual cycle viewed the male pictures somewhat longer than women in the luteal phase which is somewhat consistent with prior studies on levels of sexual interest (Bullivant et al., 2004; Van Goozen et al., 1997). During the ovulatory period, women experience a peak in fertility. From an evolutionary perspective, perhaps increased sexual interest to men of high quality (e.g., attractive men) may motivate women to have sex with and thus be more likely to reproduce with these men, resulting in better quality offspring (Bossio et al., 2014; Gangestad & Thornhill, 1998). However, as discussed earlier the extant literature on menstrual phase and women's sexual interest is inconsistent so caution must be exercised when interpreting the present results in relation to this prior work. Some studies have reported menstrual phase effects for self-reported sexual interest while others have reported no associations with viewing time towards male and female pictures (e.g. Bullivant et al., 2004 cf. Dawson, Suschinsky, & Lalumière, 2012). Some studies also indicate that menstrual phase during the initial exposure to sexual stimuli may have a stronger effect on women's sexual responses than the actual cycle phase at the time of testing but other studies do not (e.g., Suschinsky et al., 2014; Wallen & Rupp, 2010 cf. Bossio et al., 2014)

Another limitation in interpretation concerns our findings on WHR. We may have

altered the body mass index (BMI) of the women in the female pictures when we narrowed or widened the waist (e.g., Tovée, Hancock, Mahmoodi, Singleton, & Cornelissen, 2002).

Research indicates that there is positive correlation between BMI and WHR (e.g., Perilloux, Cloud, & Buss, 2013). Thus, it is difficult to determine whether changes in attractiveness ratings are based on BMI, WHR, or both. However, given the positive correlation between BMI and WHR, and the negative correlation between BMI, WHR and attractiveness ratings (e.g., Perilloux et al., 2013), the influence of BMI may not necessarily alter the direction of perceived attractiveness ratings (less or more attractive) based on WHR manipulation.

It is possible that women may gaze longer at attractive women (e.g., with WHRs of .74) because they are interpreted as potential competitors and that this extra vigilance is heightened during the ovulatory phase (Maner et al., 2009). However, we did not find that women viewed female pictures with WHRs of .74 longer than female pictures with WHRs of .68 and .89. In addition, women in the ovulatory phase did not view female pictures longer than those in the luteal phases. Some evolutionary accounts suggest threat based cognitive processing may be mediated by relationship status whereby women in stable relationships may not attend to the perceived threat posed by other attractive women (Maner et al., 2007). In Study 1, women may not attend more to potential threats because women viewed their current romantic relationship as secure and stable or they were not concerned with threats posed by intrasexual competitor (Maner et al., 2007). As we did not assess women's relationship status in Study 1 we cannot test whether this influenced our findings. Further studies should explore this possibility.

STUDY 2

In Study 1, we demonstrated that heterosexual women's viewing time towards female pictures was not associated with a manipulation of the perceived attractiveness of those pictures. Thus, it is reasonable to question exactly what factors other than reported sexual

attraction would be related to heterosexual women's viewing times for female pictures. In Study 2, we explore the possibility that physical appearance social comparisons play a role. Moreover, in order to test whether the gender differences in the gender-specificity in viewing times can be extended to a culturally different population than those of previous studies, both heterosexual men and women were recruited. This is the first test of its kind, to our knowledge, in a Chinese study population of heterosexual men and women.

Specifically, in Study 2, we recorded heterosexual men and women's viewing times and self-reported sexual attraction to pictures of males and females; and measured self-reported physical appearance social comparison. We predicted that heterosexual men would be more gender-specific than heterosexual women in their viewing time patterns. Specifically, heterosexual men were expected to view female pictures significantly longer than they did male pictures, whereas heterosexual women were expected to not demonstrate any difference in viewing times between male and female pictures. We also predicted that physical appearance social comparison would be associated with heterosexual women's viewing times for female pictures but not men's viewing time patterns. Specifically, women scoring high on social comparison were expected to view female pictures significantly longer than women who were low on social comparison.

Method

Participants

A new sample of 124 Chinese students (53 men and 71 women) was recruited from the Southwest University. Women's mean age = 20.96 years ($SD = 1.80$); men were significantly older than women, $t(122) = 5.52, p < .001$, Cohen's $d = 1.01$. Only the data of self-identified heterosexual men and women were analysed.

Questionnaire

As in Study 1, a questionnaire asked participants for their written informed consent and

demographic information. Then participants were asked to complete the Physical Appearance Comparison Scale, which is a standardized, validated scale used to measure social comparison on one's appearance (Myers & Crowther, 2009). It has four items which reflect the degree of overall appearance comparison to other individuals. An example item is "at parties or other social events, I compare my physical appearance to the physical appearance of others." Items were rated on a 5-point scale ranging from 1 = *never* to 5 = *always*. A Chinese version of scale was used which was translated from the original and back-translated (Chen, Gao, & Jackson, 2007). Thompson, Heinberg, & Tantleff (1991) reported an internal consistency coefficient of $\alpha = .78$ and test-retest reliability of $r = .72$. The Cronbach's alpha of the scale in this study was .74.

Stimulus Materials

Previous research suggests viewing time may be influenced by the particular pictures of men and women used (Israel & Strassberg, 2009). Thus, a different set of pictures were used in Study 2. Pictures of adult men and women wearing swimsuits or underwear were collected from the Internet (Lippa et al., 2010). They featured only one person per picture. Twenty-five pictures of men and 25 pictures of women were selected. These pictures were mainly of ethnic Chinese individuals, but some pictures of ethnic Caucasian persons were also included. To make sure that pictures collected are sexually attractive to the opposite gender, pictures were rated for sexual attractiveness by 62 judges who were not participants in the main study (these were all Chinese university students including 30 female judges for male pictures and 32 male judges for female pictures). They were asked to evaluate the pictures on perceived sexual attractiveness using a 7-point scale ranging from 1 ("*I am not at all sexually attracted to this person*") to 7 ("*I am extremely sexually attracted to this person*").

The mean sexual attractiveness of the female pictures as rated by male judges was 4.52 ($SD = 1.63$; Cronbach $\alpha = .93$) and the mean sexual attractiveness of the male pictures as

rated by female judges was 4.13 ($SD = 1.70$; Cronbach $\alpha = .93$).

Procedure

This was the same as that outlined in Study 1

Results and Analysis

Controlling for Outlier Values

Some trials were removed due to participant's omission of sexual attractiveness ratings for specific pictures because they missed a picture (e.g., by moving too quickly through the task). Additional trials were removed based on outlier values for viewing times (e.g. those resulting from lapses in participants' attention or fatigue during the task). We capped individual viewing time at 15 seconds in order to reduce the impact of outliers (Lippa et al., 2010). In total, only 0.67% of all the trials were eliminated.

Data transformation

This was the same as that outlined in Study 1.

Sexual Attractiveness Ratings

Table 1 presents the mean sexual attractiveness ratings as a function of participant gender and picture type. A 2 (Gender) \times 2 (Picture Type: Male, Female) repeated measures analysis of variance (ANOVA) revealed a significant gender by picture type interaction, $F(1, 122) = 334.50, p < .001$, partial $\eta^2 = .73$. The interaction was examined further by simple effects analysis comparing sexual attractiveness ratings for the two picture types separately by participant gender. This revealed that men rated female pictures significantly more sexually attractive than male pictures, $p < .001$, Cohen's $d_z = 1.84$. Women rated male pictures significantly more sexually attractive than female pictures, $p < .001$, Cohen's $d_z = 0.70$.

Viewing Time

Table 1 also presents the mean viewing time as a function of participant gender and

picture type. A 2 (Gender) \times 2 (Picture Type: Male, Female) repeated measures analysis of variance (ANOVA) revealed a significant gender by picture type interaction, $F(1, 122) = 56.97, p < .001$, partial $\eta^2 = .32$. The interaction was examined further by simple effects analysis comparing viewing time for the two picture types separately by participant gender. This revealed that men viewed female pictures significantly longer than male pictures, $p < .001$, Cohen's $d_z = 0.93$. For women, there was no difference in viewing times for male and female pictures, $p = .127$, Cohen's $d_z = 0.22$.

Correlation between Sexual Attractiveness Ratings and Viewing Times

A within-participants correlation between sexual attractiveness ratings and viewing times for each participant was calculated based on 50 pairs of scores. An average correlation was then calculated separately by gender (Ebsworth & Lalumiere, 2012). Men had an average correlation of .28 ($SD = 0.20$), indicating that the association between sexual attractiveness rating and viewing times for men was moderate. Women had an average correlation of .13 ($SD = 0.22$), indicating that the association for women was small. To test for a gender difference in the correlation coefficients, the within-participants correlation coefficients were converted to z values using the Fisher's z transformation and an average z value was calculated separately by gender, $z = 0.31$ ($SD = 0.24$) and $z = 0.14$ ($SD = 0.24$) for men and women, respectively. There is no significant difference between the coefficients, $Z = 0.91, p = .363$.

Correlation between Physical Appearance Social Comparison and Viewing Time

The correlation between physical appearance social comparison with viewing time was computed separately by picture type and gender. For men, there were no significant correlations between physical appearance social comparison and viewing time ($r = .03, p = .852$ and $r = -.02, p = .901$ for male and female pictures, respectively). For women, there was a significant positive correlation between physical appearance social comparison and

viewing time for female pictures ($r = .38, p = .001$), and a significant negative correlation between physical appearance social comparison and viewing time for male pictures ($r = -.37, p = .001$).

The Relationship between Sexual Attractiveness Ratings, Physical Appearance Social Comparison, and Viewing Time

To test whether sexual attractiveness ratings or physical appearance social comparison affect viewing time, a stepwise linear regression was carried out separately by gender and picture type. Viewing time was entered as the dependent variable, and the sexual attractiveness ratings and physical appearance social comparison were entered as independent variables. For viewing time for female pictures, the regression revealed that women's viewing time for female pictures were predicted by sexual attractiveness ratings for female pictures ($B = 0.22, 95\% \text{ CI} = 0.09 - 0.34, p = .001$) and physical appearance social comparison ($B = 0.03, 95\% \text{ CI} = 0.01 - 0.04, p < .001$). Sexual attractiveness ratings for female pictures and physical appearance social comparison accounted for 27.5% of the variance, $F(2, 68) = 12.87, p < .001$. The regression also revealed that men's viewing time for female pictures were predicted by sexual attractiveness ratings for female pictures ($B = 0.25, 95\% \text{ CI} = 0.05 - 0.46, p < .05$). Sexual attractiveness ratings for female pictures accounted for 10.5% of the variance, $F(1, 51) = 5.95, p < .05$.

For viewing time for male pictures, the regression revealed that women's viewing time for male pictures were predicted by sexual attractiveness ratings for male pictures ($B = 0.23, 95\% \text{ CI} = 0.10 - 0.35, p < .001$) and physical appearance social comparison ($B = -0.03, 95\% \text{ CI} = -0.04 - -0.01, p < .001$). Sexual attractiveness ratings for male pictures and physical appearance social comparison accounted for 28.0% of the variance, $F(2, 68) = 13.25, p < .001$. The regression also revealed that men's viewing time for male pictures were predicted by sexual attractiveness ratings for male pictures ($B = 0.25, 95\% \text{ CI} = 0.05 - 0.46, p < .05$).

Sexual attractiveness ratings for male pictures accounted for 11.2% of the variance, $F(1, 51) = 6.45, p < .05$.

Discussion

In Study 2, we found that heterosexual men were more gender-specific than heterosexual women in their viewing time patterns. Men viewed female pictures significantly longer than they did male pictures, whereas women tended to split their attention more evenly between pictures of the two genders. This finding supports those of previous studies but also extends those findings to a Chinese sample for the first time, and provides much needed cross-cultural replication (e.g., Ebsworth & Lalumiere, 2012; Israel & Strassberg, 2009; Lykins et al., 2008).

As predicted, the results also revealed that physical appearance social comparison was positively associated with heterosexual women's viewing times for female pictures. Physical appearance social comparison was not associated with men's viewing time patterns. It is possible that women scoring higher on social comparison activate as yet poorly studied decision-making processes or cognitive mechanisms in relation to the women depicted in the stimuli to influence viewing times (Manner et al., 2007; 2009).

The regression analysis revealed that both physical appearance social comparison and sexual attractiveness ratings predicted women's viewing time for female pictures. This finding suggests that two different processes may combine to influence women's viewing time pattern. However, sexual attractiveness ratings for female pictures and physical appearance social comparison only accounted for 27.5% of the variance. Thus, other factors must contribute to the complexity of women's viewing time patterns to attractive stimuli

Moreover, we found that neither heterosexual men nor women exhibited a strong concordance between sexual attractiveness rating and viewing time. This finding is consistent with previous research (Ebsworth & Lalumiere, 2012; Israel & Strassberg, 2009). Among

men, one possible explanation is that people may tend to prefer looking at attractive pictures in general, whether or not these pictures are male or female (Lippa et al., 2010). In addition, rating the sexual attractiveness of sexual stimuli required participants to judge the stimuli in terms of gender, sexual maturation, and attractiveness. Consequently, the task demands may have contributed to longer viewing times. Indeed, Imhoff et al. (2012) suggested that the longer viewing time of sexually appealing targets was mainly due to task-specific processes triggered by the visual stimuli. Thus, the task demands and the very brief viewing times (with an average less than 3.5s) may be another possible explanation accounting for the low concordance found in men. For women's the present results could indicate that factors such as social comparison contribute to the low concordance between sexual attractiveness rating and viewing time. This requires further study.

GENERAL DISCUSSION

In the present research we aimed to test the extent of gender-specificity in heterosexual women's viewing time towards pictures which vary in their perceived attractiveness and to explore the influence of social comparison of physical appearance on their viewing time. In Study 1, we found that heterosexual women's patterns of reported sexual attractiveness of the stimuli by WHR were not entirely consistent with their patterns of viewing time by WHR. Thus, our results indicate that heterosexual women's viewing times for female pictures may not be a strong indicator of the perceived attractiveness of female pictures. In Study 2, we found that heterosexual men were more gender-specific than heterosexual women in their viewing time pattern. Moreover, we found that both sexual attraction and physical appearance social comparison are associated with heterosexual women's viewing times for female pictures.

An interesting implication from the current study was that two different processes may combine in some manner to influence women's viewing time pattern. Firstly it is possible that

emotional interest in the attractive stimuli increased visual attention and vigilance towards the stimulus (Singer, 1984). This interest need not be a sexual in nature and maybe an aesthetic response to the stimuli. Thus viewing time may serve as an adjunct measure of attention (be it aesthetic, emotional, or sexual) towards attractive stimuli and further research is needed to separate between these hypothesized components (cf. Singer, 1984 and also see Gress, 2005; Kalmus & Beech, 2005). A second factor, and somewhat distinct from attention-capture driven by aesthetic, emotional or sexual interest, is attention-capture driven by social comparison of physical appearance. Evolutionary psychologists have suggested that physical appearance comparisons with conspecifics may allow women to identify potential intrasexual competitors and adjust their own attractiveness and mating behaviors accordingly in order to enhance mate retention (Maner et al., 2007). When rating the sexual attractiveness of female pictures heterosexual women in our study may have compared their appearance with the women pictured and this may have influenced their attractiveness judgements. This factor may contribute to the appearance of gender-nonspecificity in viewing time patterns.

While this study did not directly measure sexual arousal, we note that some authors have pointed to possible advantages of viewing time over self-report and genital measures (Israel & Strassberg, 2009). Although our studies looked at perceived attractiveness of the stimuli used, they do point to the limitations inherent in using viewing time as an indicator of attention towards appetitive stimuli (whether this indicates sexual interest or not). We have already shown that one other factor, social comparison, may influence viewing times towards attractive stimuli. Thus the putatively sexual content of the stimuli alone cannot be inferred from viewing time results. The fact that social comparison judgments are processed differently by men compared to women (or that men place less emphasis on certain kinds of social comparisons, such as those about relative levels of physical attractiveness of potential male conspecifics), may also influence viewing time patterns as found here (that is,

gender-nonspecificity among women and gender-specificity among men). Moreover, although this finding could improve the current understanding of gender differences in gender-specificity in sexual interest using unrestricted viewing time paradigms (both the pictures and sexual attractiveness rating scale were presented until participants rated the pictures), it cannot explain women's weaker gender-specificity in sexual interest using restricted viewing time paradigms (in which the pictures were presented for 750/500 ms, then removed and followed by the sexual attractiveness rating scale; more details were reported in Imhoff et al., 2010) and women's genital sexual arousal (e.g., Chivers et al., 2007; Peterson et al., 2010).

Another limitation in interpretation concerns our findings on social comparison. If women are sensitive to the physical attractiveness of potential competitors (and viewing time was an indicator of this), women should have viewed the pictures of women with a WHR of .74 significantly longer than those of women with WHRs of .68 and .89 in Study 1. Thus, the results from Study 1 seem to contradict this hypothesis. However, it maybe that WHRs which are too low or too high are indicative of other aspects of physical appearance, such as cues to disease states or poor health indicators, which then influence attention patterns; it is also possible that these images represent unusual or highly novel visual stimuli which simply capture attention by virtue of their atypical appearance likelihoods (e.g., Park, Schaller, & Crandall, 2007; Ackerman et al., 2009). For instance, Ackerman et al. (2009) found that physical abnormalities capture attention due perhaps to individuals' motivation to avoid disease. Here, pictures of women with a WHR of .68 and .89 (who were viewed for longer than pictures of WHR of .74) may have been associated with either very thin or over-weight individuals and so drawn attention for those reasons. Alternatively these WHRs may have acted as cues associated with stigmatized groups (such as over-weight individuals) or cues to disease states (Park et al., 2007). These alternative explanations require rigorous study in

future research.

The present research had additional limitations that require some comment. First, the participants were all university students. University students may differ from other populations regarding their sexual experiences and attitudes towards sex; therefore, it remains unknown if the patterns of responses observed herein can be generalized to older, more ethnically diverse or less educated groups of heterosexual men and women. Second, participants were classified as heterosexuals according to their self-reported sexual identity. Savin-Williams (2009) has pointed out that the assumed prevalence of non-heterosexuals depends on which component is used to assess sexual orientation, and which criteria are used to classify individuals as homosexual. Thus, one item that the current study used may have led to the inclusion of some non-heterosexual participants. Third, we did not use biological methods to verify women's menstrual cycle status. This is a major limitation of the present research and so we repeat our request that the findings are interpreted with caution. Given that the validity of forward or backward counting method assessments of cycle phase are modest at best (Gangestad et al., 2016), backwards counting in absence of confirmation via hormones can be problematic (Gildersleeve & Haselton, 2014). Moreover, menstrual cycle phase was not accounted for in Studies 2. Fourth, we did not use more direct methods (e.g., ask participants to recall social comparisons) to confirm whether heterosexual women did indeed compare their physical appearance to women of female pictures. Fifth, the participants in the current set of studies were all heterosexuals and so it will be interesting to cross-validate the methods and findings in studies of non-heterosexual participants. Future studies should address these limitations in order to ascertain whether the results presented herein can be replicated in similar populations, as well as across sexual orientations and socio-cultural groups.

In conclusion, we found that in general heterosexual men were more gender-specific

than heterosexual women in their viewing time patterns. We also found that both self-reported sexual attractions and physical appearance social comparison were associated with heterosexual women's viewing times for female pictures, while heterosexual men's viewing times were associated with sexual attractiveness ratings only. Our results suggest that the use of viewing time as a possible adjunct measure of aesthetic, emotional, or sexual interest in appetitive stimuli (especially for heterosexual women) be subject to further rigorous study.

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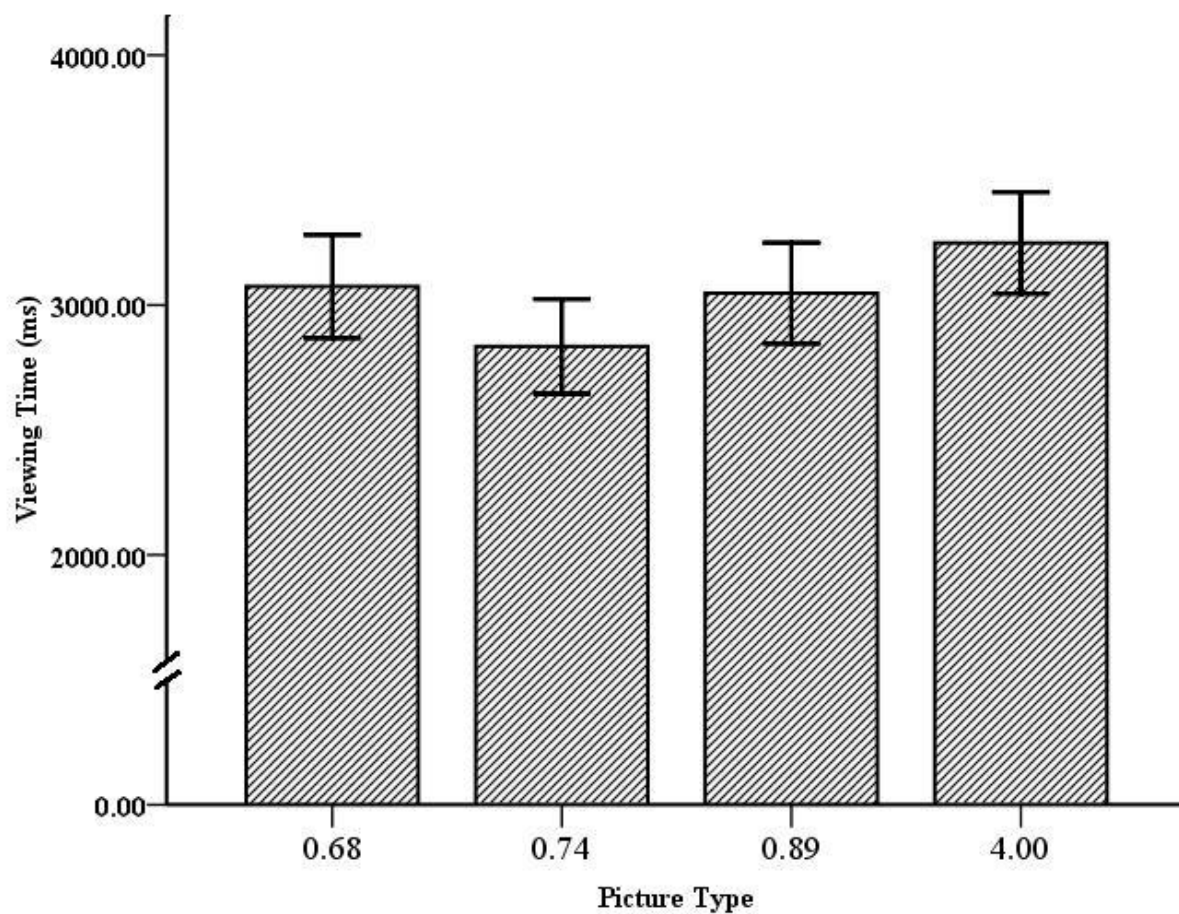
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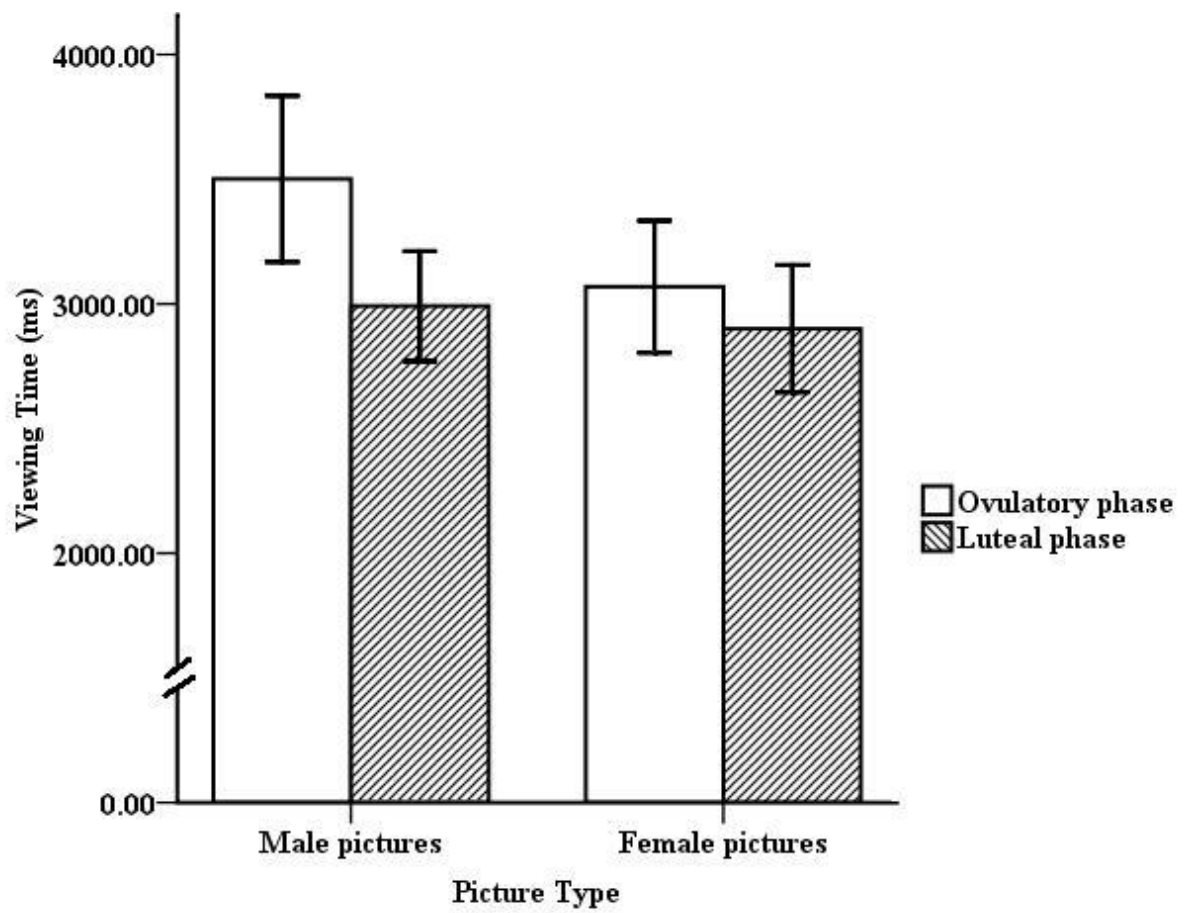
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Fig. 1 Women's viewing time of female pictures with three WHRs and male pictures (Study 1)



Note: the error bars signify the 95% confidence interval of viewing time

Fig. 2 Women's viewing time by menstrual cycle and picture type (Study 1)



Note: the error bars signify the 95% confidence interval of viewing time

Table 1 Means and standard deviations for sexual attractiveness ratings and viewing time (Study 2)

Variable		Men (<i>n</i> = 53)		Women (<i>n</i> = 71)	
		Mean	<i>SD</i>	Mean	<i>SD</i>
Sexual attractiveness ratings	Male picture	1.89 (1.60, 2.18)	1.02	4.03 (3.78, 4.28)	1.10
	Female picture	4.95 (4.62, 5.27)	1.13	3.10 (2.82, 3.38)	1.24
Viewing time	Male picture	2261.44 (1975.65, 2547.22)	1035.24	3285.88 (3038.96, 3532.79)	1062.54
	Female picture	3088.84 (2805.75, 3371.94)	1162.14	3085.49 (2840.90, 3330.08)	941.15